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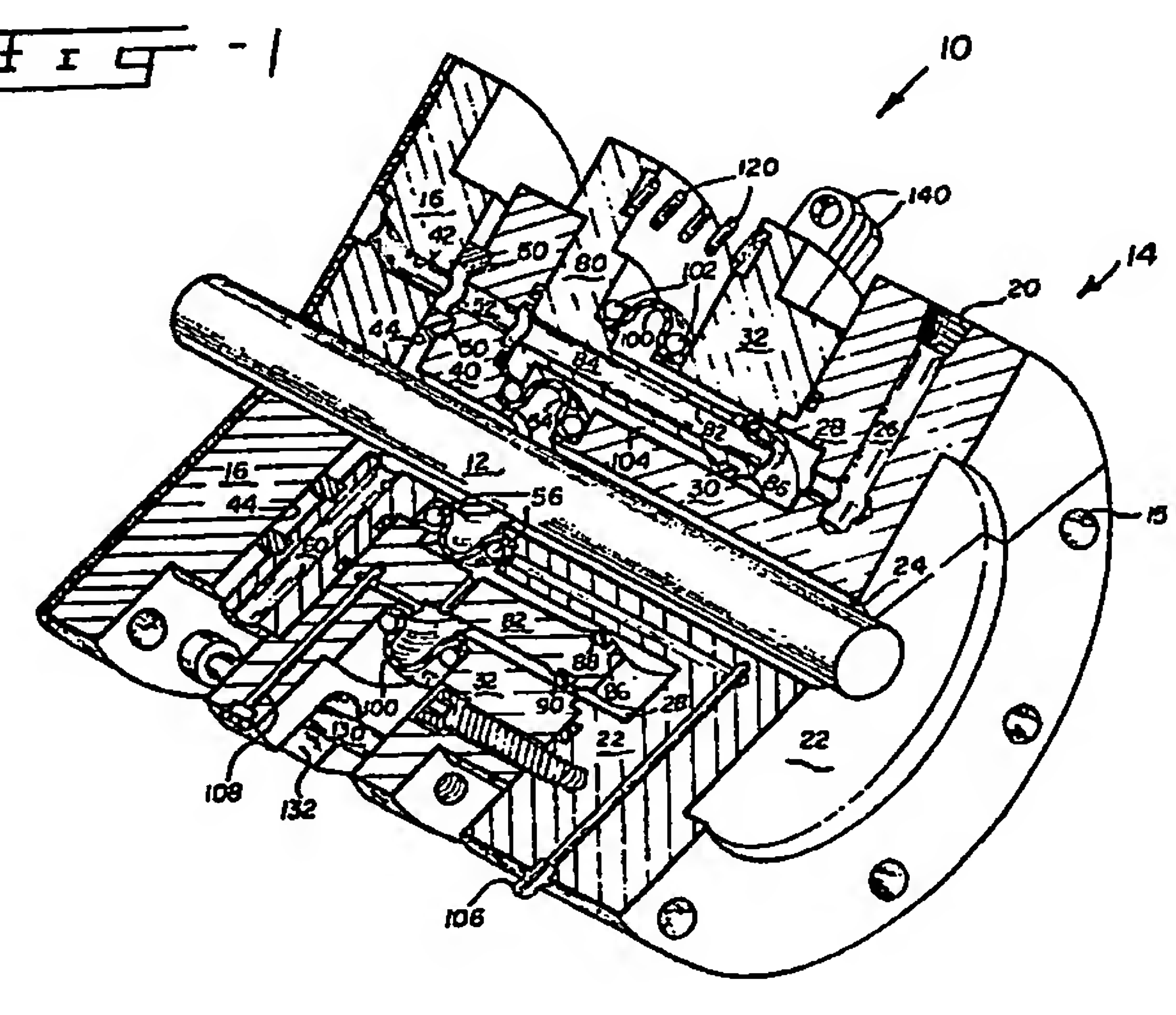
(54) Flexible fluid conduit for propeller shaft

(57) This disclosure is directed to a flexible fluid conduit means 14 for directing fluid from a pressure source to a propeller of a ship for minimizing cavitation. The conduits formed of split annular rings adapted to be mounted over a propeller shaft, the rings being interconnected to form passages 26, 52 for directing air pressure from the A-bracket through relative rotating seal members 40, 80 and into the body of the propeller. The disclosed interconnection of the annular rings permits substantial axial and bending movement of the propeller shaft without loss of air. Being submersed, the conduit is hydraulically balanced such that the force of water pressure tending to open the seal members is always less than the force tending to close the seal members.

FIG-1



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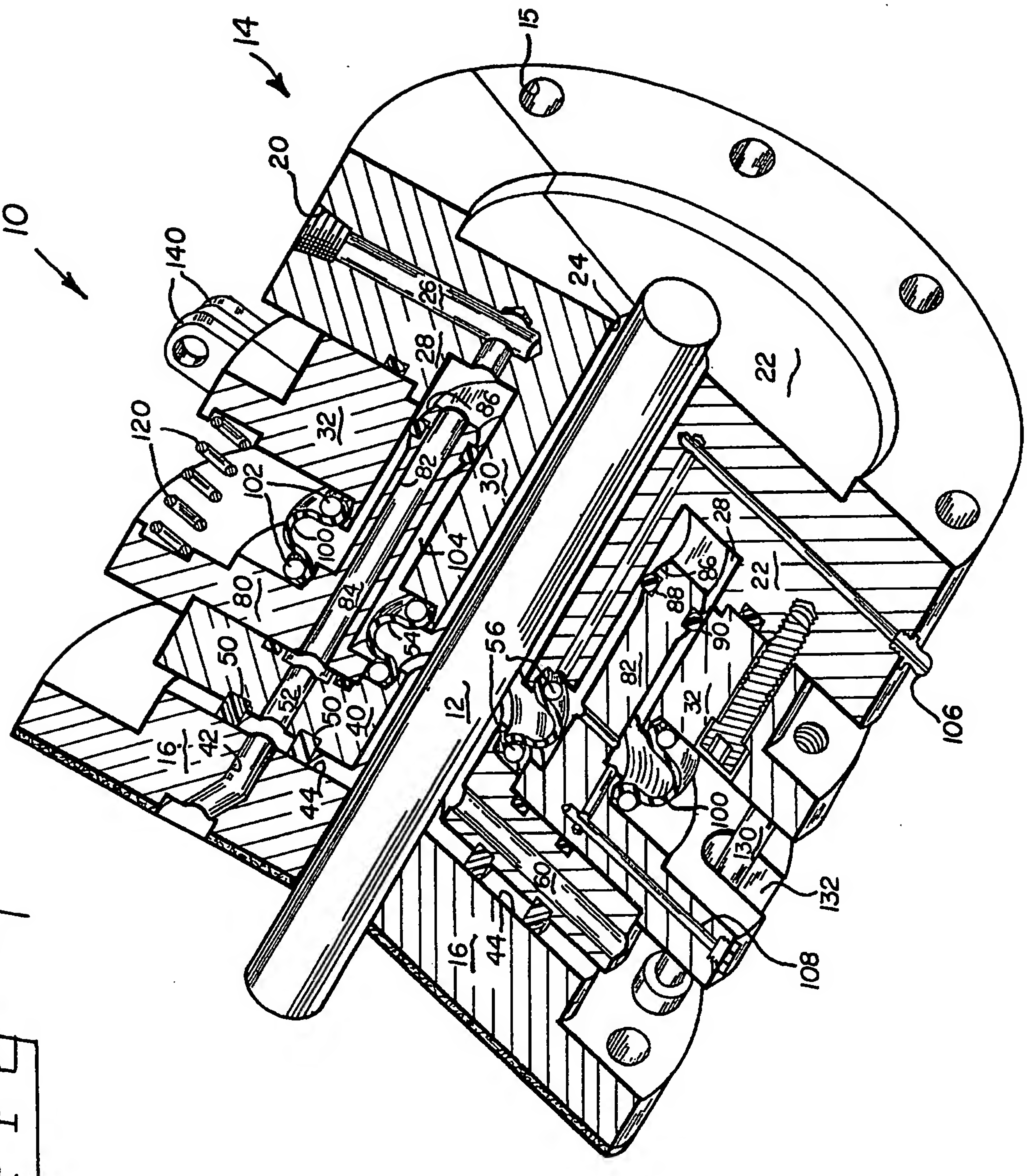

FIG-1

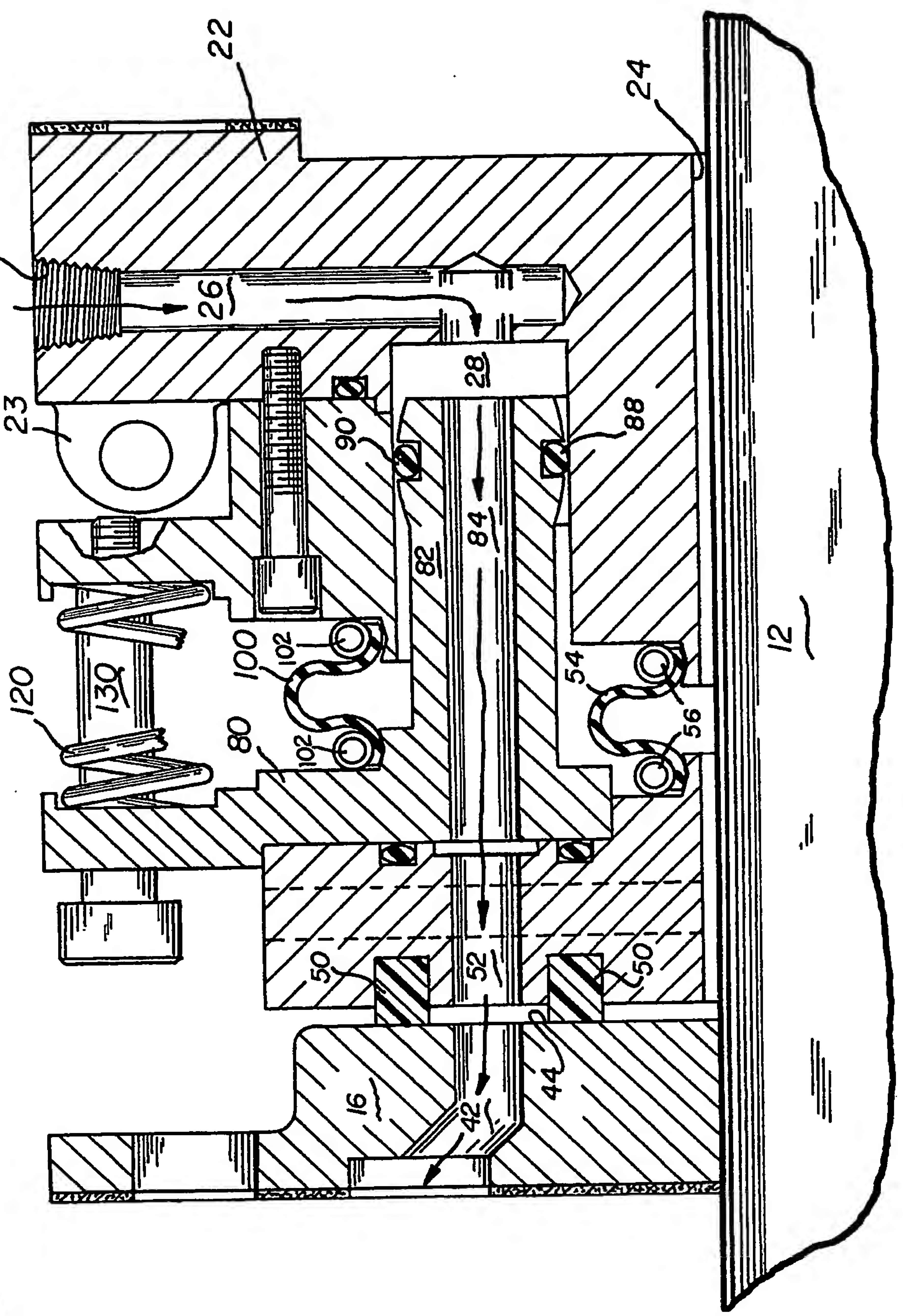
14
20
22
24
26
28
23
90
88
84
82
100
102
102
54
56
120
130
80
12
50
52
50
44
42
16

FIG-2

SPECIFICATION

Flexible fluid conduit for propeller shaft

This invention is concerned generally with an apparatus for improving propulsion of ships by reducing cavitation and more specifically concerned with apparatus for conducting air to the propeller blades to improve operation thereof.

Discharge of air through the propeller blades of ships is believed to reduce cavitation. In the past, this air has been directed through the propeller shaft to the propeller and out of its blades. In ships having A-bracket supported propeller shafts, a flexible conduit mounted coaxially on the shaft for directing air from the bracket to the propeller is believed desirable.

Such a conduit presents substantial design problems. First, the conduit must be interconnected with a rigid A-bracket and the rotating propeller. Such necessitates a relative rotating seal which is subjected to varying external water pressure and varying air pressure within the conduit. Second, the propeller and its shaft are subject to axial movement of, in some cases, one and one-quarter inches as well as radial movement. Finally, such a conduit should not interfere with sea water lubrication of A-bracket stave bearings which journal the propeller shaft.

This invention relates to a fluid conduit adapted to be attached to an A-bracket for a ship and to extend coaxially of a propeller shaft towards the propeller, said conduit including a body portion having an aperture therethrough and having air passages for receiving air and transmitting same to the propeller, an relative rotating seal means adapted to be interconnected between said body portion and said propeller for sealing said conduit against loss of air.

This invention further relates to a fluid conduit adapted to be attached to an A-bracket of a ship and extend coaxially of a propeller shaft towards a propeller, said conduit including a body portion formed of split ring members and having air passages for receiving air and transmitting same to a propeller, and relative rotating seal means adapted to be interconnected between said body means and a propeller for sealing said conduit against loss of air.

To overcome the discussed design problems, the present invention has been developed and will now be described with reference to the accompanying drawings showing a preferred embodiment of the invention, wherein:

Figure 1 is a perspective view of the flexible fluid conduit means of our invention, with portions broken away; and

Figure 2 is a side elevational view in section of the flexible fluid conduit means of our invention.

As depicted in Figure 1, the preferred embodiment of the invention, namely a flexible conduit 10 is mounted over a propeller shaft 12 of a ship. The conduit 10 includes a body portion 14 formed of several ring members adapted to be bolted through apertures 15 (or otherwise affixed) to the A-bracket (not shown) extending from the ship's hull to rotationally support shaft 12. This body portion 14 extends rearwardly to sealingly engage a rotating mating ring 16 which is affixed to a propeller boss (not shown). Within the body portion 14 and mating ring 16 are various passages (indicated by arrows) which receive air flow from port 20 and directs air flow through mating ring 16 to the propeller boss. Conduits (not shown) within the boss then direct the air flow to the propeller blades.

As previously suggested, the propeller and mating ring 16 may move axially relative to the A-bracket of the ship. The relative rotation occurs between the body portion 14 and mating ring 16. Finally, the propeller shaft 12 is subjected to bending forces which must be accommodated by the conduit 10. The preferred structure of the elements accommodating such movement while maintaining a sealed air conduit will be described.

Preferably each element of the seal is split or formed of two halves which may be conveniently bolted together over to shaft 12. A basic element of body 14 is the mounting member or housing 22. In cross section, shown in Figure 2, the mounting member is generally L-shaped and has a central aperture 24 of sufficient diameter to provide a clearance between it and shaft 12. One or more ports 20 are provided on the circumference of the housing for receiving air. This air is then, by drilled passageways 26, directed radially inward to an enlarged axially extending fluid passage 28. This passage is defined by the horizontal extension 30 of mounting 22 and by an annular retainer 32 which is bolted to the mounting 22 at a plurality of locations. In assembly, the split halves of mounting member 22 are first attached to the ship A bracket (not shown) and bolted together through ears 23.

Next, the split mating rings 16 are bolted to each other and to the propeller boss (not shown) for rotation therewith. This mating ring has fluid passages 42 which receive air from the body portion 14 and delivers same to the boss. Since the mating ring rotates relative to body portion 14, it is provided with a flat, radially extending sealing surface 44. To seal the passage 42 from sea water, two split annular sealing rings 50, 50 are mounted upon the split primary sealing ring 40, the sealing rings 50, 50 being disposed on opposite sides of air passages 42. Preferably these sealing rings are formed of a phenolic resin-asbestos composition, commercially available. An air passage 52 of primary seal member 40 is also disposed between rings 50, 50 to mate with passage 42.

The primary sealing ring 40 is then connected to the extension 30 of mounting member 22 by an annular flexible diaphragm 54. This diaphragm may be formed of material and in the manner of diaphragms long used in stern tube seals. As shown in drawings, the opposite sides of the diaphragm 54 are mounted on lips of the primary sealing ring 40 and on the extension 30 by circumferential cables 56. Upon assembly of the diaphragm 54, the central aperture 24 of body portion 14 is sealed to provide a passage for sea water to lubricate the propeller shaft 12 as it rotates within the rubber staves of the A-bracket. Sea water is thus allowed to pass through

the A-bracket, along propeller shaft 12 within body portion 14 and out radially drilled apertures 60 of primary sealing ring 40.

With the primary sealing ring 40 and mounting means 22 installed, the fluid passage for transmitting air from port 20 to mating ring 16 can be completed. For this purpose two more split members are positioned about extension 30 to define another annular member 80 having a forward extension 82. This fluid transfer member 80 is provided with a plurality of air passages 84. The extension 82 extends forward towards passage 28 of mounting means 22 and its air passage 84 complete to air conduit between port 20 and the mating ring 16.

After installation of fluid transfer member 80, the split retainer 32 can be then bolted to the mounting ring 22. Once in place, the internal diameter of retainer 32 in conjunction with the external diameter of extension 30 defines an elongated passage 28 in which extension 82 may telescope. Thus, if the propeller shaft moves rearwardly one inch, the extension 82 can merely telescope within passage 28 and the air passage is not affected. Similarly, the end of extension 82 is curved at 86 and provided with internal and external 0-rings 88 and 90. This feature of the invention seals the air passage while permitting limited bending deflections of the propeller shaft 12.

Subsequent to installation of the retainer ring 32, a second external diaphragm 100 is mounted upon lips of the retainer and transfer member 80 and tightened with cables 102. The two diaphragms 54 and 100 further isolate the air passage from sea water; permit the axial movement of fluid transfer member 80; and define a cavity 104 which is filled with a high viscous fluid such as grease. This grease may be introduced into cavity 104 through a sert 106 and passages drilled in body member 22 as shown. Preferably another drilled aperture 108 in transfer member 80 is used to indicate when cavity 104 is full as grease emerges therefrom. As subsequently discussed, this grease is subjected to sea pressure through flexible diaphragms 54 and 102 and contributes to the balancing of radial seals 50.

To complete assembly of the conduit 10, a plurality of compression springs 120 are inserted between member 80 and retainer 32 at circumferentially spaced points. These springs bias sealing rings 50, 50 into engagement with surface 44 of mating ring 16. Finally, a plurality of bolts 130 extend through apertures 132 of transfer means 80 for threaded engagement with retainer 32. The heads of these bolts are spaced from member 80 to permit free axial movement of that member. Yet, these bolts constrain member 80 against rotation. In addition to these specifically described elements, various 0-rings may be employed as shown in the drawings to better seal the air passage from sea water. Apertured ears such as those shown at 140 are mounted on opposite sides of each split member and may be used to bolt the parts together.

In operation, air delivered to port 20 is transmitted through the air passages described into the mating ring 16. To preclude loss of air, the seal rings 50, 50 must remain in sealing contact with surface 44 during normal operation and upon axial movement of the propeller and mating ring 16 relative to the A-bracket. This sealing engagement requires proper dimensioning of the areas upon which sea pressures and air pressure are imposed. Generally, it is anticipated that the conduit will be subjected to approximately 20 psi of sea pressure. A summation of the areas on which sea water is tending to open seal members 50 and those areas in which water is acting to close the seal members will reveal that the sea water will always impose a net closing force even upon maximum extension of the conduit as limited by the ends of bolts 130. Such area summation includes the radial areas within cavity 104 since grease in this cavity is subjected to sea pressure through flexible diaphragms 54 and 100. In addition, the springs 120 will impose additional sealing force. Finally a summation of the radial areas within the main air passages 26, 28, 84, 52 and 42 will reveal a net sealing force at most air pressures.

From this description of the preferred embodiment, those skilled in the art will appreciate that the flexible conduit, as disclosed permits relative rotation, axial and bending movement between opposite ends of the conduit. Too, various modifications will suggest themselves to persons skilled in the art.

CLAIMS

1. A fluid conduit adapted to be attached to an A-bracket of a ship and extend coaxially over a propeller shaft towards a propeller, said conduit including a body portion formed of split ring members and having air passages for receiving air and transmitting same to a propeller; and relative rotating seal means adapted to be interconnected between said body means and a propeller for sealing said conduit against loss of air.

2. An apparatus according to claim 1 in which said seal means includes a radially extending surface adapted to be mounted for rotation with the propeller and having fluid passages therein for receiving air from said body means, and said body means mounts sealing washers radially disposed on opposite sides of said air passages for sealing said passages against loss of air.

3. An apparatus according to claim 1 or 2 in which said body portion includes annular members having means to permit relative axial movement therebetween without loss of air.

4. An apparatus according to claim 1 or 2 in which said body portion includes annular members having means to permit relative axial and bending movement therebetween without loss of air.

5. An apparatus according to any of claims 1 to 4 in which the areas of said conduit are proportioned and balanced in a manner such that fluid pressure imposes a net closing force on said seal means.

6. A split fluid conduit adapted to be mounted about a propeller shaft for transmitting air from A-bracket to a propeller for minimizing cavitating, said conduit permitting axial and bending movement of said propeller shaft, said conduit including an annular mounting member having an aperture extending therethrough for mounting over a prop-

eller shaft, said member adapted to be attached to an A-bracket of a ship and having fluid transfer means for receiving fluid and transferring same towards said propeller, a fluid transfer member having first passage means extending into the fluid conduit of said annular mounting member, said first passage means being coupled to said fluid conduit by means permitting relative axial and bending movement between said first passage means and said fluid conduit, said coupling including sealing means for precluding loss of fluid, and seal means interposed between said fluid transfer member and said propeller, said seal means including second passage means for transferring fluid from the fluid transfer member to said propeller, and a radially extending sealing surface on oposite sides of said second passage means for precluding loss of fluid.

7. An apparatus according to claim 1 in which the areas of said conduit are proportioned and balanced in a manner such that fluid pressure imposes a net closing force on said seal means.

8. An apparatus according to claim 6 or 7 in which said first passage means is isolated from sea water by circumferential flexible diaphragms mounted externally and internally of said first passage means to define a cavity for receiving a high viscous fluid.

9. A device according to any of claims 6 to 8, wherein the annular mounting member comprises a ring member, the fluid transfer member being of annular form and telescoping into the fluid transfer means of said mounting ring for permitting relative telescopic and bending movement of said members, and said seal means being radially spaced and affixed to said transfer member as well as sealingly conected to said propeller, said means having a fluid passage in the propeller.

10. A fluid conduit adapted to be attached to an A-bracket of a ship and extend coaxially of a propeller shaft towards a propeller, said conduit including a body portion having an aperture therethrough for mounting over a propeller shaft, said body portion having an annular mounting means for attachment to an A-bracket, and an axially extending member mounted for telescopic movement relative to said body member, fluid passages extending through said mounting means and said axially extending member for transmitting air therethrough, and relative rotating seal means for interconnecting said body portion with a propeller for transmitting air to a propeller.

11. An apparatus according to claim 10 in which said seal means includes a radially extending surface adapted to be mounted for rotation with the propeller and having fluid passages therein for receiving air from said body means and said body means mounting sealing washer radially disposed on opposite sides of said air passages from sealing said passages against loss of air.

12. An apparatus according to claim 10 or 11 in which said fluid passages of said body portion are isolated from sea water by flexible diaphragms defining a cavity for receiving a high viscous fluid.

13. An apparatus according to claim 10 or 11 in which the diameter of said aperture is greater than that of said shaft for permitting sea water to flow therebetween, said body means having radially extending passages for permitting sea water to exit from the space defined by said shaft and said aperture.

14. A fluid conduit for attachment to the A-bracket of a ship constructed substantially as herein described with reference to the preferred embodiments disclosed in the accompanying drawing.

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